

Armed Forces College of Medicine

AFCM



Pathology of bone tumors (1)

INTENDED LEARNING OBJECTIVES (ILO)



By the end of this lecture the student will be able to:

1. **Classify bone tumors & enumerate them.**
2. **Enumerate benign bone tumors**
3. **Discuss pathology of compact osteoma & osteoid osteoma**
4. **Describe pathology of benign cartilage forming tumors**
5. **Describe the pathology of giant cell tumor of bone.**
6. **Mention the radiologic findings of giant cell**

Lecture Plan



1. **Part 1 (5 min) Introduction**
2. **Part 2 (35 min) Main lecture**
3. **Part 3 (5 min) Summary**
4. **Lecture Quiz (5 min)**

Bone Tumors



B

Bone tumors

Primary

Secondary (metastatic)

Benign

Locally aggressive

Malignant

TUMORS OF BONE



BENIGN	LOCALLY MALIGNANT	MALIGNANT
Osteoma & osteoblastoma	Giant cell tumor	OSTEOSARCOMA
Osteochondroma (exostosis)	Adamantinoma (Ameloblastoma)	Chondrosarcoma
Chondroma	Chordoma	Fibrosarcoma
Chondroblastoma		Ewing's sarcoma
Chondromyxoid fibroma		Plasma cell neoplasms
Fibroma		
Others: hemangioma		

Benign bone tumors



Osteoma

- **Compact osteoma.**
- **Osteoid osteoma and**
- **Osteoblastoma**

Compact Osteoma



Site: Flat bones of the skull and face.

Gross: A hemispherical, non capsulated, hard, ivory like mass.

Microscopic:

Well-differentiated mature lamellar bony trabeculae separated by fibrovascular tissue.



http://www.pathologyoutlines.com/topic/boneosteoma.html

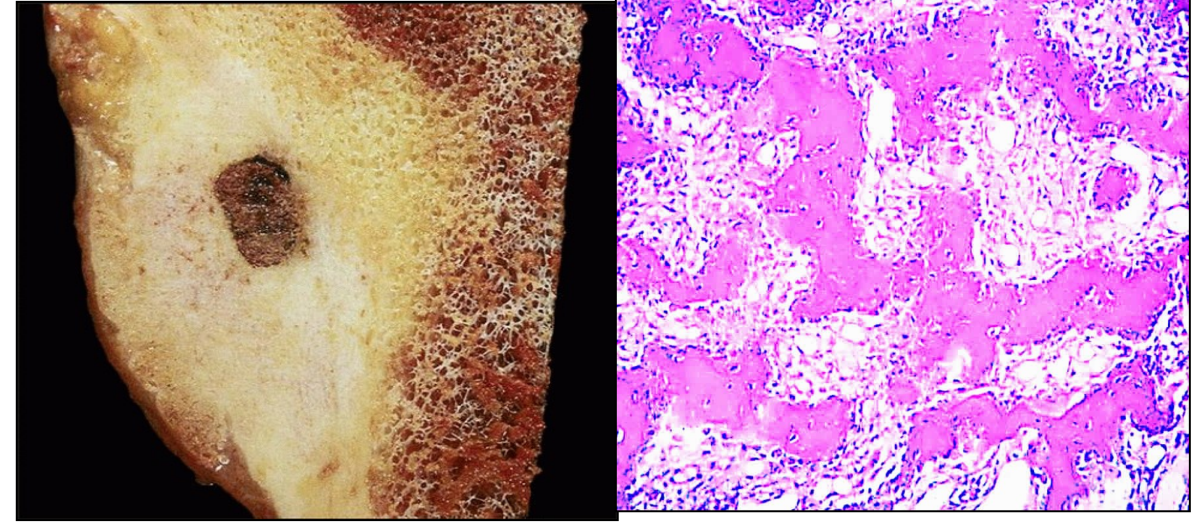
Osteoid Osteoma



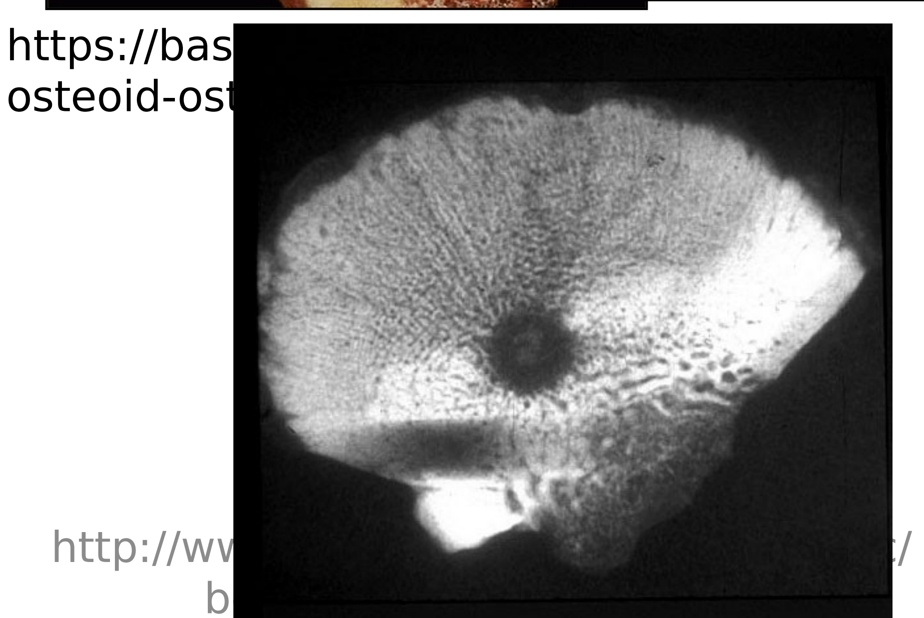
C\P:

- **The tumor is associated with noctural pain, due to production of prostaglandin E2, by proliferating osteoblasts.**
- **The pain is markedly improved by salicylates .**

X- ray: A radiolucent



https://bas
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Osteoid Osteoma



- ***Size:*** **Small (usually less than 1cm).**
- ***Site:*** **The diaphysis of a long bone, often the tibia or femur.**
- ***Gross:*** **A well defined, gritty & friable.**
- ***Mic:*** **Trabeculae of osteoid woven bone, surrounded by sclerotic bone formation.**

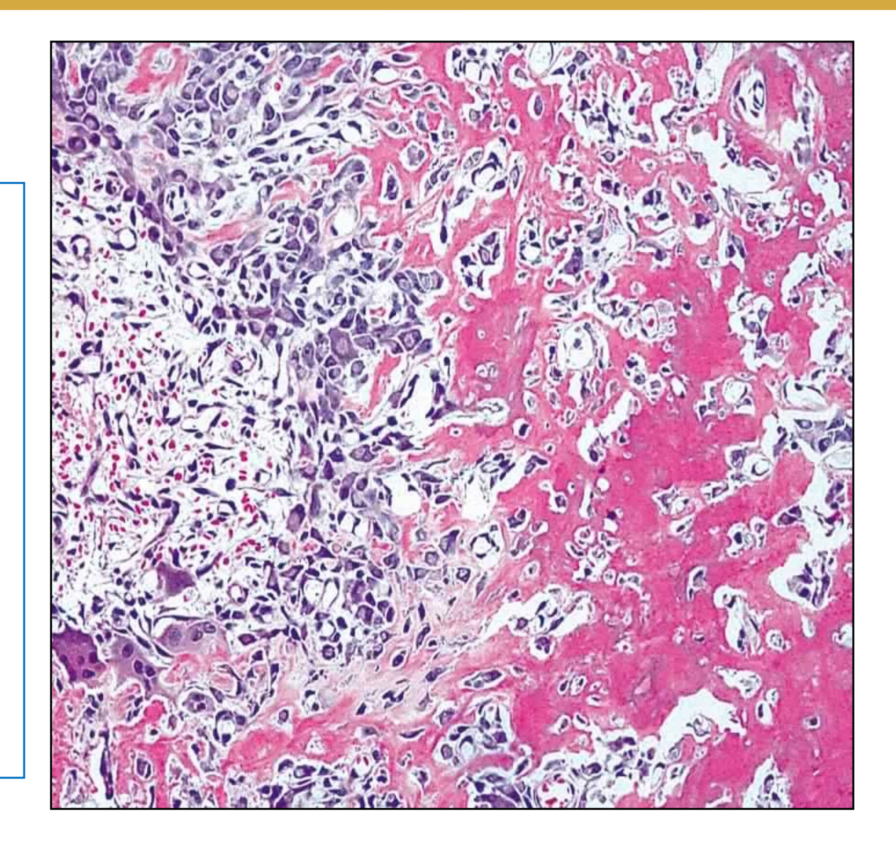
http://www.tumorsurgery.org/tumor-education/bone-tumors/types-of-bone-tumors/osteoid-osteoma.aspx

Osteoblastoma



- *It is similar to an osteoid Osteoma but*

  * Larger (>2 cm).
  * Often involves vertebrae.



http://www.pathologyoutlines.com/topic/boneosteoblastoma.html

BENIGN CARTILAGE-FORMING TUMOURS (CHONDROBLASTIC)



1-Osteocartilaginous Exostoses (Osteochondromas)
2- Enchondroma

Osteocartilaginous Exostoses (Osteochondromas)



- It is not a true tumor but regarded as a disorder of growth & development.
- It originates from aberrant lateral growth of epiphyseal growth plate .
- ***Incidence:***
- They are the commonest of benign cartilage-forming lesions.



https://www.youtube.com/watch?v=94hmcpM24aA

https://radiopaedia.org/cases/osteochondroma-13

Osteocartilaginous Exostoses (Osteochondromas)

- ***No:*** ***single or multiple .***
- ***Size:*** **Small (usually < than 1 cm).**
- ***Site:*** **Metaphysis of long bones, most commonly lower femur and upper tibia (i.e. around knee) .**



https://en.wikipedia.org/wiki/Hereditary_multiple_exostoses

Osteocartilaginous Exostoses (Osteochondromas)



- ***Gross:***
  Mushroom-shaped, cartilage-capped lesions.
- ***Mic:***
- ***Outer cap composed of mature cartilage**
- ***Inner mature lamellar bone and bone marrow.**
- ***Clinical picture:*** **Asymptomatic, pain, deformity, or undergo malignant transformation (rare)**



https://emedicine.medscape.com/article/1256477-workup



Enchondroma



- **Enchondroma: It is a <u>benign</u> cartilage-forming tumour that develops within the medullary cavity of bone.**
- ***<u>Site:</u>* Mostly the short tubular bones of the hands and feet.**
- ***<u>Clinical picture:</u>* Usually asymptomatic.**
- ***<u>Complication:</u>* Malignant transformation into chondrosarcoma, which is**





http://www.texasfootdoctor.org/enchondror

Enchondroma



No:

Single or multiple (*enchondromatosis*).

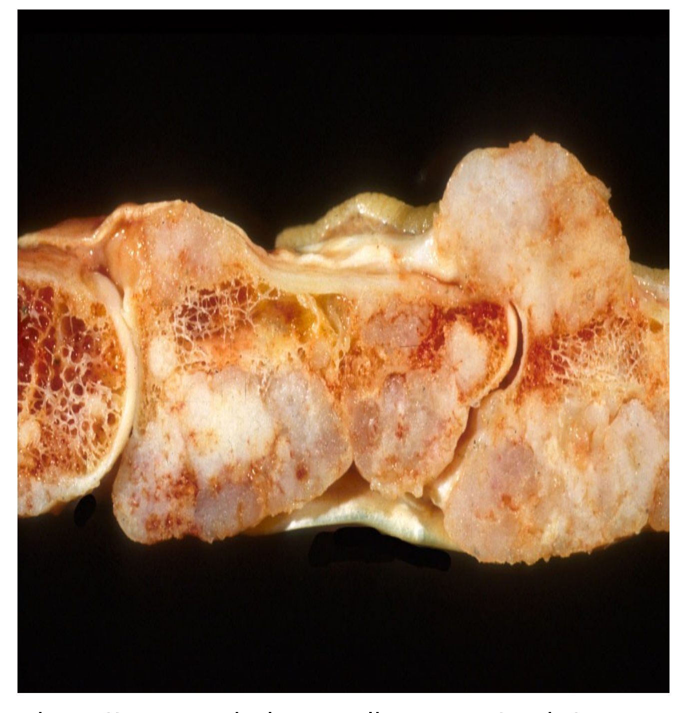
- ***Maffucci's syndrome*: Multiple enchondromas with multiple soft tissue haemangiomas.**

Gross:

A lobulated, bluish-grey, translucent, cartilaginous mass.

Mic:

Normal adult hyaline cartilage separated by fibro-vascular stroma.



http://www.pathologyoutlines.com/topic/bonechondromaenchondromaslongbones.html

TUMORS OF BONE



BENIGN

- Osteoma & osteoblastoma
- Osteochondroma (exostosis)
- Chondroma
- Chondroblastoma
- Chondromyxoid fibroma
- Fibroma
- Others: hemangioma

LOCALLY MALIGNANT

1-Giant cell tumor

2- Adamantinoma (Ameloblastoma)

3- Chordoma

MALIGNANT

- OSTEOSARCOMA
- Chondrosarcoma
- Fibrosarcoma
- Ewing’s sarcoma
- Plasma cell neoplasms

Giant cell tumor (osteoclastoma



- **<u>Age:</u>**
  - **Usually after the age of <u>20 years</u> but may occur in younger ages.**
  - **Most giant cell tumors are <u>locally malignant</u>.**
  - **Few cases (10-20%) are <u>malignant</u> and metastasize.**
- **<u>Site:</u>**
  - **Around the <u>knee joint</u> (distal femur , proximal tibia)**
  - **Both <u>epiphysis</u> and <u>metaphysis</u>**



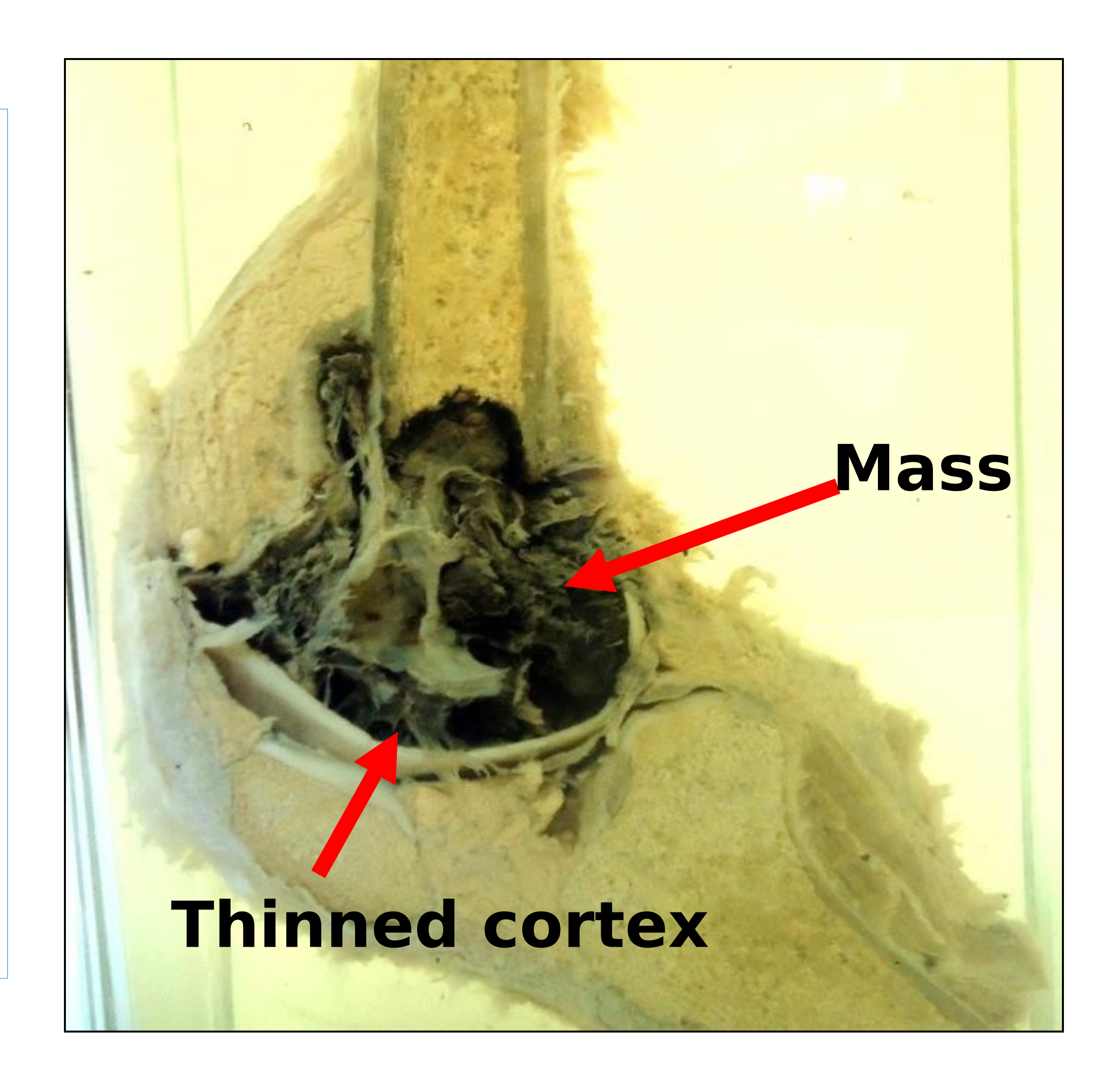
https://www.youtube.com/watch?v=hY08PVkqPr

Giant cell tumor (osteoclastoma)



Gross:

- An **eccentric mass** that erodes subchondral bone
- The tumor tissue is **grayish brown** with **cystic degeneration** filled with hemorrhage.
- The covering cortical bone becomes markedly **thinned** (**egg shell-like**).



Giant cell tumor (osteoclastoma)



Microscopic:

Multinucleated giant cells

Mononuclear tumor cells

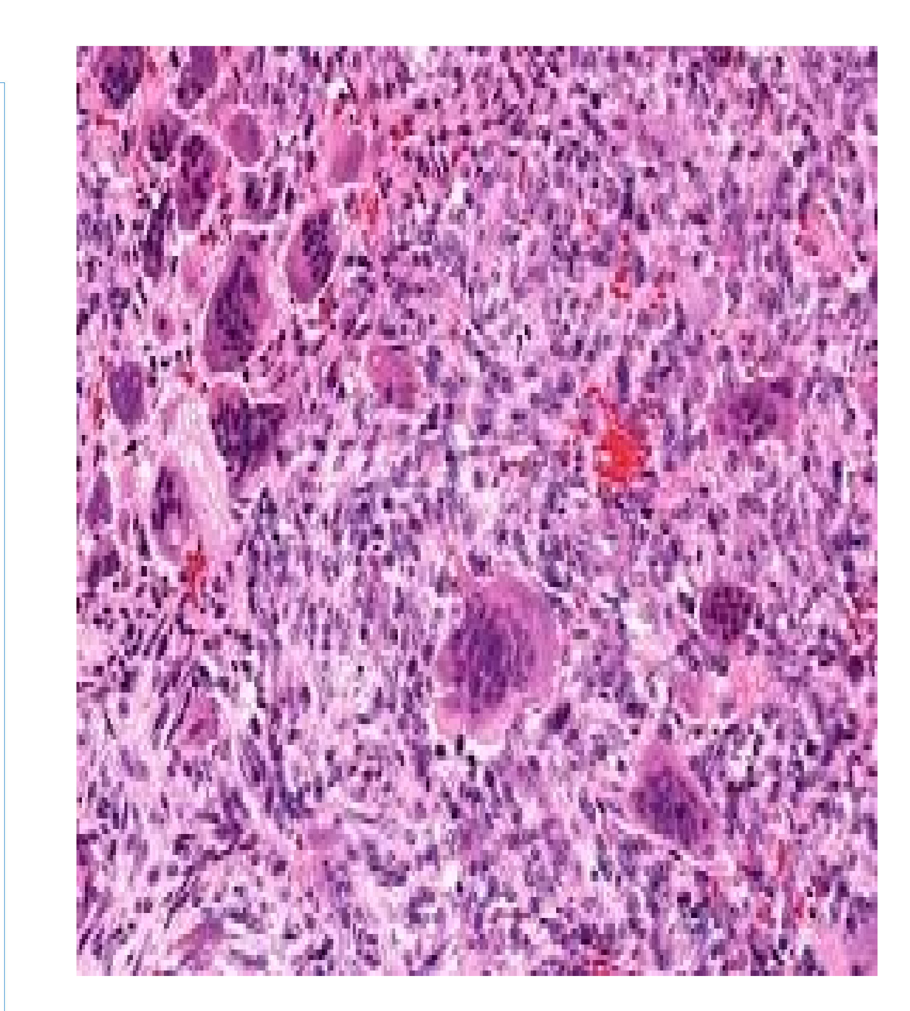
Collagenous stroma, vessels and areas of hemorrhage.

Giant Cell Tumor Of Bone (OSTEOCLASTOMA)



Microscopic:

1. ***Neoplastic cells:***
   Oval mononuclear stromal cells, dark nuclei with variable atypia.
2. ***Non neoplastic cells:***
   Multinucleated giant cells; osteoclastic type, containing up to 100 nuclei.
3. ***Stroma:*** **Collagenous, proliferated vessesls with areas of hemorrahge.**



http://ilovepathology.com/giant-cell-tumor-bone/

Giant cell tumor (osteoclastoma)



Microscopic:

Multinucleated giant cells (up to 100 nuclei) (osteoclastic type) **NON-NEOPLASTIC** (fusion of monocytes-macrophages)

Neoplastic **Stromal mononuclear TUMOR CELLS**

Oval, mononuclear, dark nuclei with atypia

Giant cell tumor (osteoclastoma)



Eccentric osteo**lytic** lesion with an adjacent **thinned cortex** and with **no periosteal reaction** (**soap bubble like**).

Bubbles

Soap bubble appearance

Giant cell tumor (osteoclastoma



Spread:

- 80-90% of cases spread **locally**.
- The remaining cases may have a malignant behaviour and metastasize by blood.

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Chondroma	Chordoma	3-Fibrosarcoma
Chondroblastoma		4-Ewing’s sarcoma
Chondromyxoid fibroma		5-Plasma cell neoplasms
Fibroma		
Others: hemangioma		

OSTEOSARCOMA (Osteogenic sarcoma) -1

- It <u>is the **most common primary malignant tumor** of bone</u>.
- The neoplastic cells are **<u>osteogenic</u>** ▯ secrete bone matrix (osteoid and/or osseous tissue).

<u>Predisposing Factors:</u>

1. Trauma.
2. Irradiation.
3. Paget’s disease of bone.
4. Fibrous dysplasia.
5. Osteochondroma

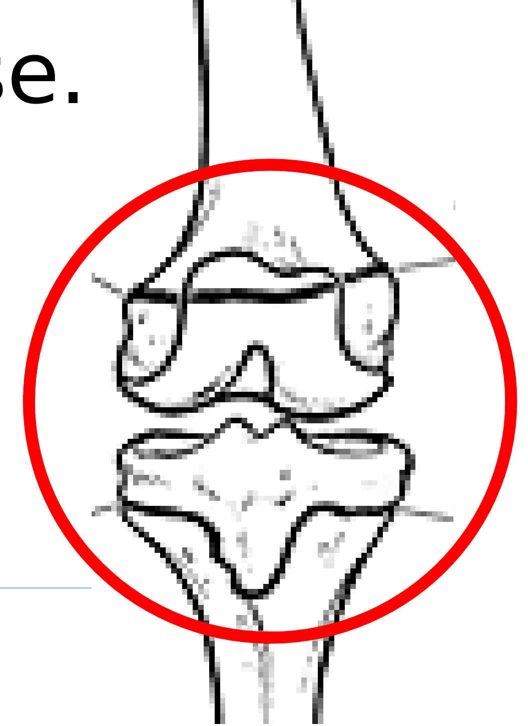


Osteosarcoma

https://www.oncoplus.co.in/category/blogs/bone-cancer/

OSTEOSARCOMA (Osteogenic sarcoma) -1

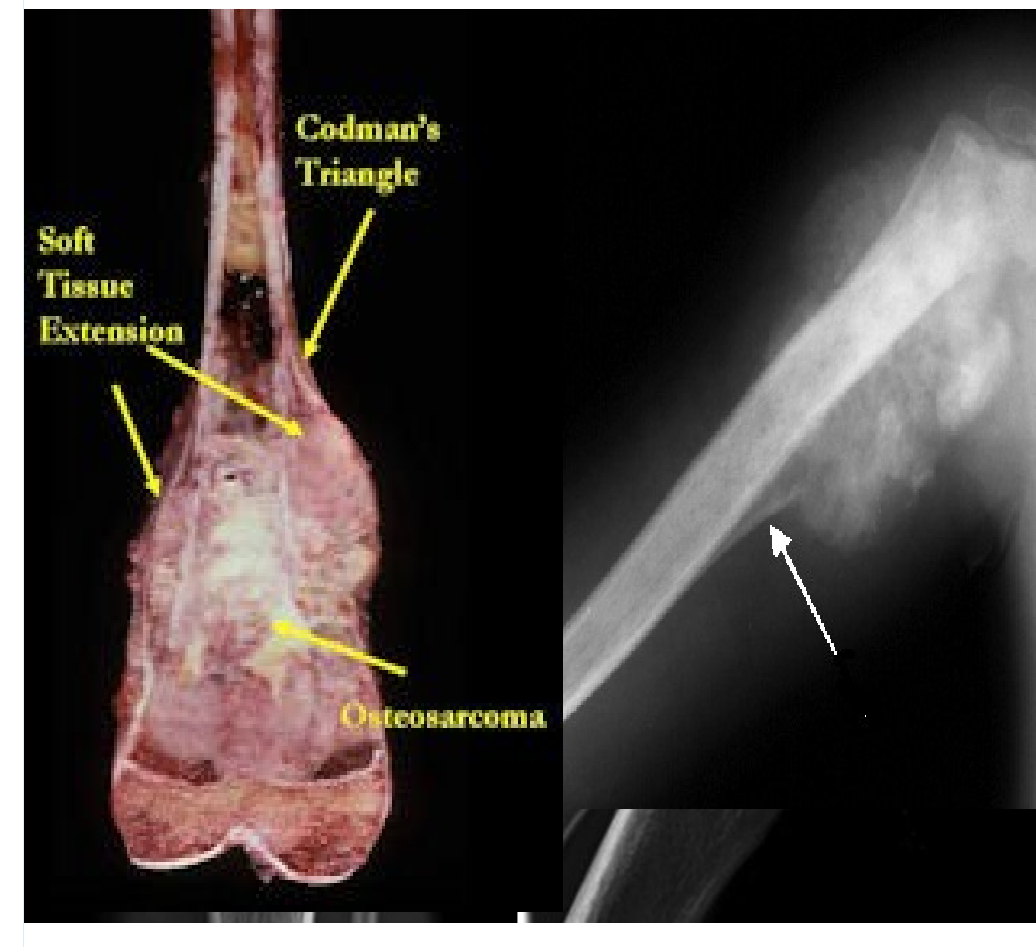
- **Age:**
  - Children and young adults, usually **below 20 years.**
  - In the elderly on top of Paget's disease.
- **Sites:**
  - Distal femur and proximal tibia
  - Starts within the **metaphysis**



OSTEOSARCOMA (Osteogenic sarcoma) -1

Radiological Features:

1. Tumors rich in bone matrix may exhibit
   Sun ray appearance in X ray films.
2. Periosteal elevation may be associated with reactive periosteal bone formation in the triangle between the cortex and elevated periosteum. This can be



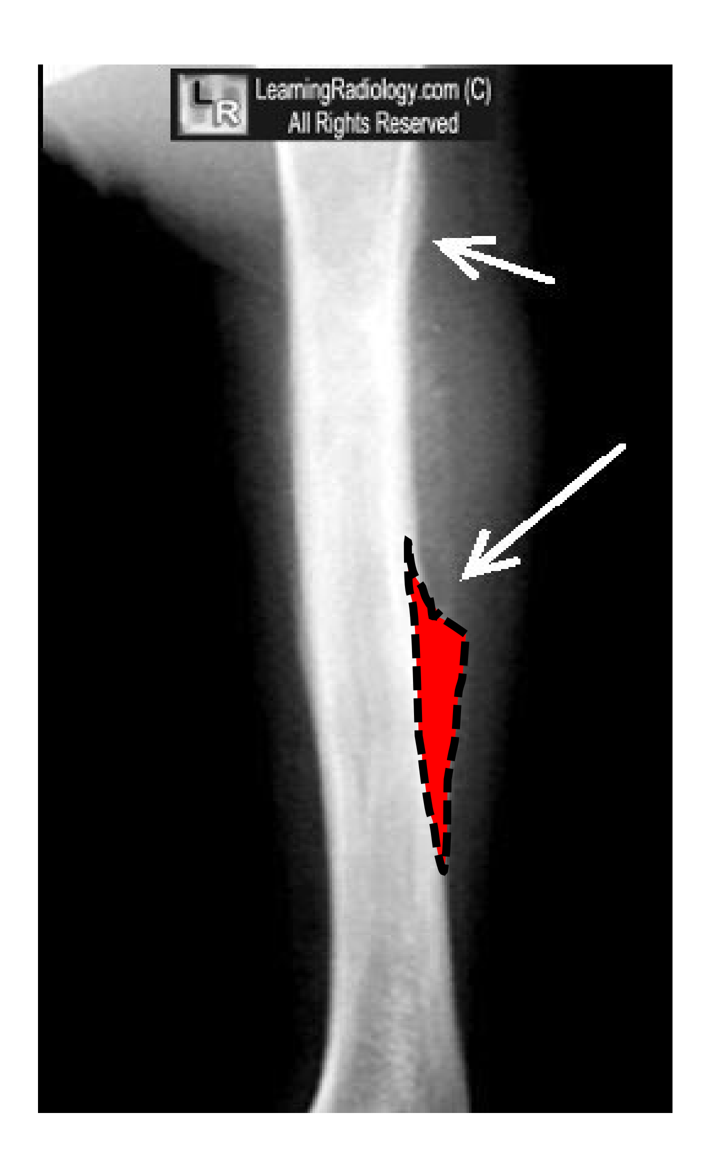
OSTEOSARCOMA (Osteogenic sarcoma) -1



Sun-ray

OSTEOSARCOMA (Osteogenic sarcoma) -1

Codman triangle

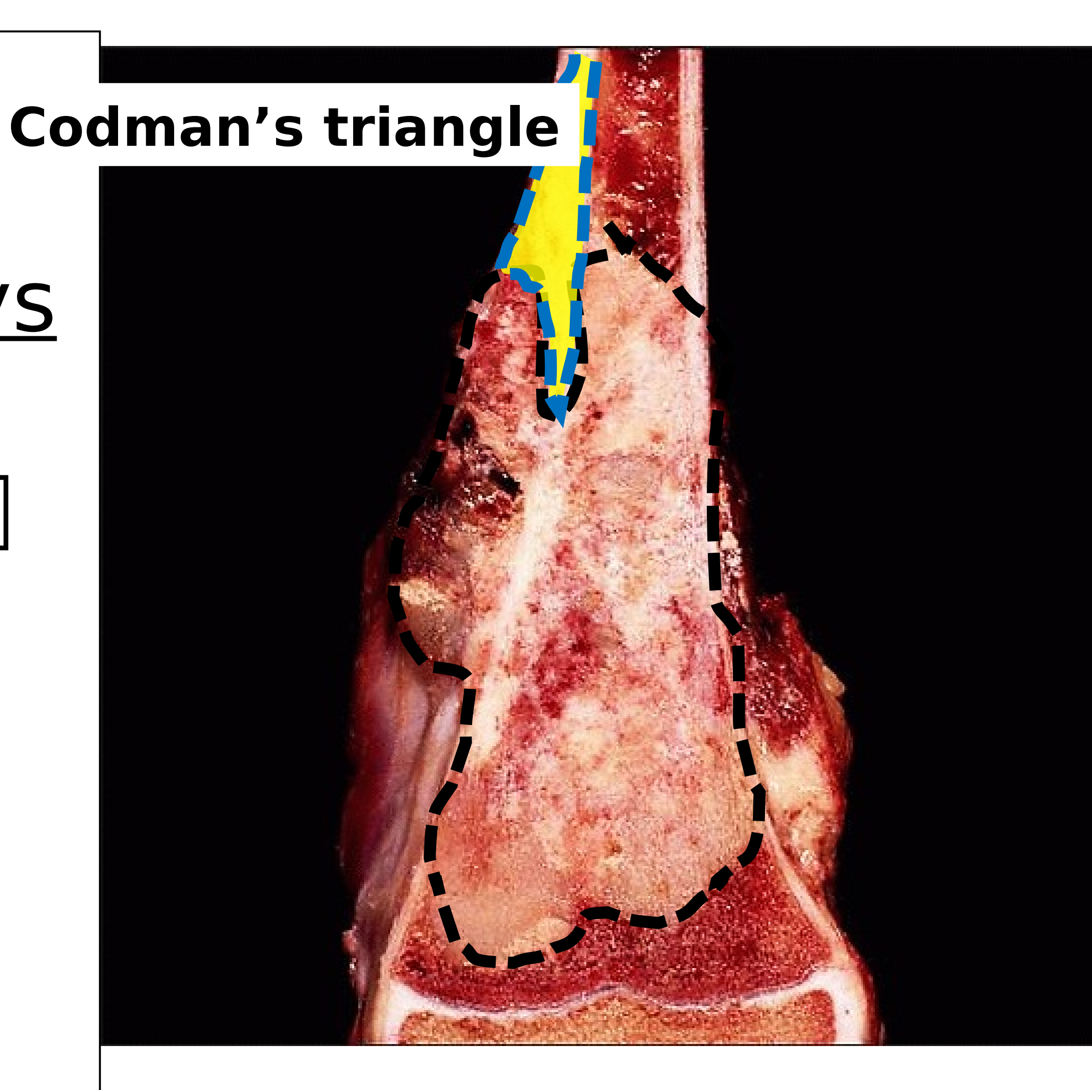


Codman's

OSTEOSARCOMA (Osteogenic sarcoma) -1

Gross:

- Large mass within the **medullary canal** and destroys the bone cortex.
- The **periosteum** is elevated penetrated extension adjacent soft tissue.
- Hemorrhage and necrosis are usually extensive.
- Osteo**sclerotic** or Osteo**lytic** according to the degree of



OSTEOSARCOMA (Osteogenic sarcoma) -1

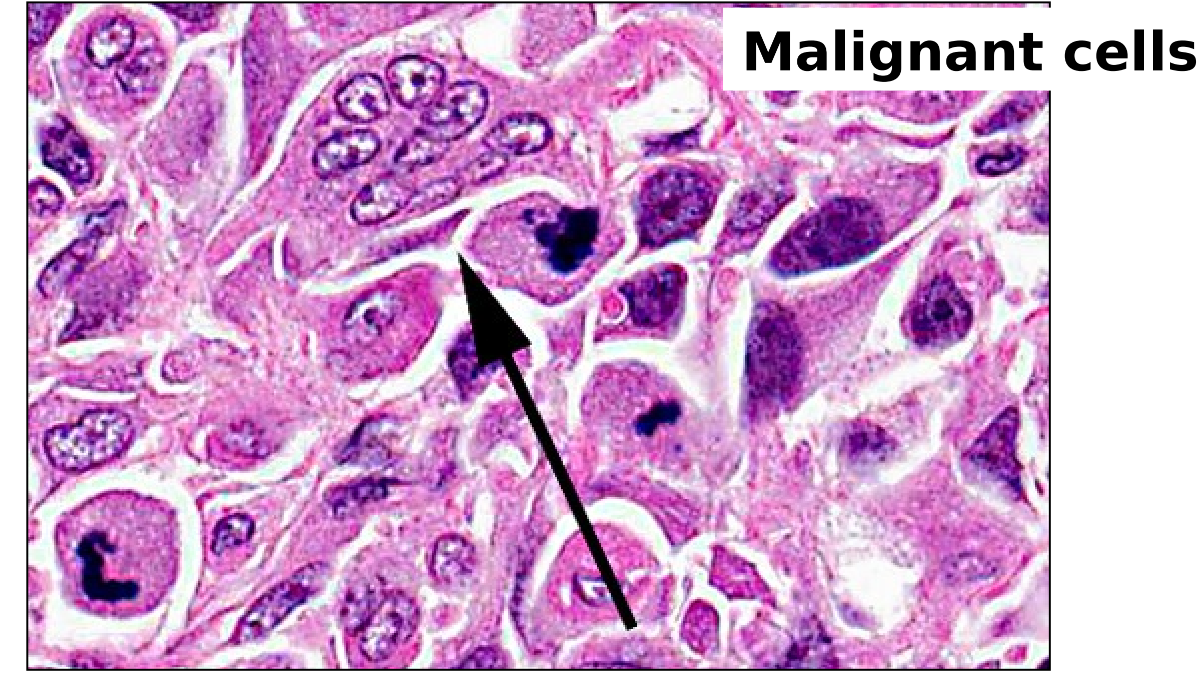


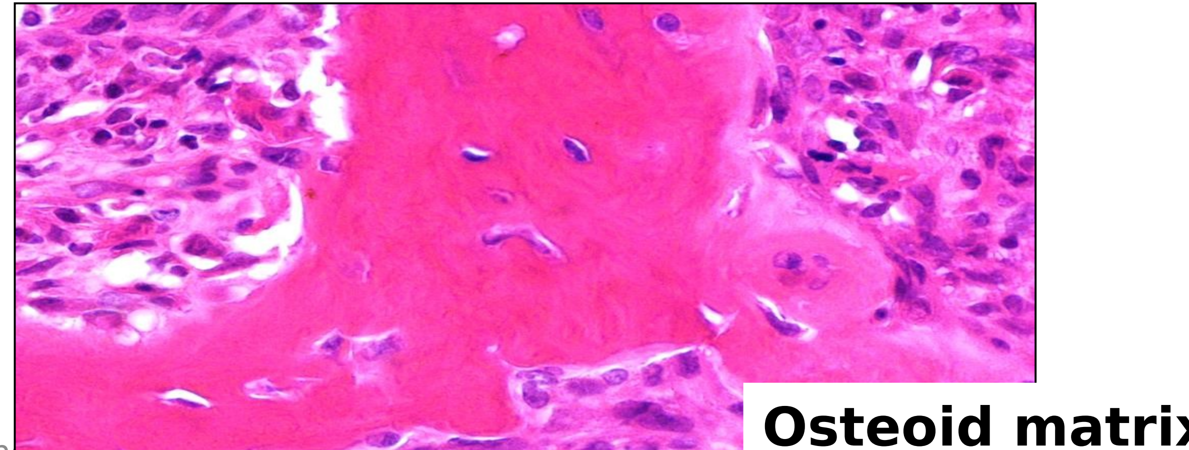
Microscopic:

1. **Tumor cells**: Pleomorphic (spindle cells) with large dark nuclei and abnormal mitotic activity.
2. **Matrix** : Osteoid tissue (prominent in better differentiated tumors, minimal in poorly differentiated tumors).
3. **Thin-walled vessels** are present
4. Areas of necrosis and hemorrhage are frequent.

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OSTEOSARCOMA (Osteogenic sarcoma) -1





OSTEOSARCOMA (Osteogenic sarcoma) -1



- **Spread:**
  - Direct surrounding soft tissue
  - Blood spread lung and other sites
- **Prognosis**:

  Highly malignant tumor rapid spread and poor prognosis



Lecture Quiz



A 15 years old male, presented with pain and swelling around his left knee joint that started few weeks ago. X- ray was done and revealed an osteolytic metaphyseal mass lesion with adjacent periosteal elevation and subperiosteal triangular reaction. **A biopsy from this lesion will reveal:**

A. Islands of epithelium in a fibrous stroma.
B. Multinucleated giant cells, round cells and fibrous stroma
C. Increased number of lymphocytes and plasma cells
D. Pleomorphic spindle cells and osteoid matrix
E. Large amount of osteoid matrix and benign fibroblasts

Lecture Quiz



A growth arises in the upper tibia, grossly appearing as a mushroom shaped mass:

a. This is a benign tumor.
b. It arises also in skull bones.
c. It originates from medullary canal.
d. Is called exotosis.
e. Spreads by blood

SUGGESTED TEXTBOOKS



1. Robbins basic pathology, ninth Edition
2. Kaplan step 1 pathology lecture notes 2017 (P.78-98)